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EXAMINER	
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ART UNIT	PAPER NUMBER
1745	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/072,907	CHOI ET AL.	
	Examiner	Art Unit	
	Raymond Alejandro	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,17,38 and 39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,17,38 and 39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02/12/02 & 07/27/05* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Appeal Brief

This communication is supplied in reply to the Appeal Brief dated 09/05/06. Even though Applicant has not yet overcome the prima-facie case of obviousness as set forth in the Final office action dated 02/06/06, prosecution of the present application is re-opened only for the Applicant's benefit of having the opportunity to fairly review the English language translation of the Japanese publication JP 47-028431 which is cited in the rejection of the present claims under Section 103; and thus, to avoid any potential confusion or allegation regarding incorporation of a new ground of rejection and/or interpretation of the prior art of record due to the consideration of the entire disclosure of the JP'431 publication (*as now available*) and which might, to some extent, give the impression of incorporating previously unavailable teachings in an Examiner's Answer if such answer would have been provided in response to the above-mentioned appeal brief. Hence, fairness and clarity of record is maintained herein by way of the present action. Additionally, a 112 rejection for a claim is presented and for which appropriate correction or clarification is required. Rejection of the present claims follows:

Claim Disposition

1. In sum, claims 10-16 and 18-37 are or have been cancelled.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claim 5 is indefinite as it recites that "*an average particle size of the elemental sulfur is greater than 0 μm and is up to 20 μm*"; and claim 1, from which it ultimately depends, requires that "*the active sulfur is disposed in the pores during an electrochemical reaction of the lithium-sulfur battery*" and also requires that the average pore size be less than and including 15 μm. Indefiniteness arises because it is unclear how an average particle size of elemental sulfur greater than 15 μm (*i.e. when average particle size of elemental sulfur ranges 15 μm < average particle size ≤ 20 μm, this applies only when the average particle size is greater than 15 μm*) can be disposed in an pore having an average pore size no greater than 15 μm. If the (average) pore size is smaller than the (average) particle size, then, it is not understood how the particle can be accommodated, introduced or disposed in the pore? Further clarification is thus required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-4, 8-9, 17 and 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu 5523179 in view of the Japanese publication JP 47-028431 (herein called "*the JP'431 publication*"- See English translation provided herewith).

The present claims are drawn to a lithium-sulfur battery wherein the disclosed inventive concept comprises the specific positive active material.

As to claims 1-3:

Chu discloses battery cells comprising a sulfur-based positive composite electrode wherein the active sulfur is elemental sulfur or sulfur containing discharge products of elemental sulfur; a negative electrode comprises lithium metal such as lithium metal or lithium-aluminum alloys (ABSTRACT/CLAIM 1/ CLAIM 9). It is disclosed that the positive electrode comprises an electronically conductive material and an ionically conductive material (COL 5, lines 1-9). The electrolyte separator is also taught (CLAIM 1). It is disclosed that the electrolyte separator for solid state batteries functions as a separator for the positive and the negative electrodes, and as a transport medium for the metal ions (COL 11, lines 9-15). It is also disclosed that for battery cells containing a liquid electrolyte such battery format contains a separator within the liquid electrolyte (COL 11, lines 35-42). *Thus, the battery cell has a separator and an ion-conducting electrolyte.*

As to claims 4 and 8:

Chu teaches the use of elemental sulfur per se and conductive material (COL 4, lines 27-35/ COL 5, lines 1-15); it is disclosed that the term "active sulfur is defined to be elemental sulfur or sulfur that would be elemental if the positive electrode were in its theoretical fully charged state (COL 8, lines 32-35); it may also comprise binders (COL 5, lines 25-28). This composition is intermixed (COL 5, lines 1-8); it's dispersed in a composite matrix by being mixed (COL 8, line 45 to COL 10, line 10). It is disclosed that the positive electrode slurry is cast directly onto a SS current collector (COL 10, lines 58-65).

Furthermore, as to the method limitation, i.e. i) mixing (ball mill), ii) coating, iii) removing, iv) injecting, v) employment of a plasticizer and its removing solvent and the likes, it is further noted that a method limitation incorporated into a product claim does not patentable distinguish the product because what is given patentably consideration is the product itself and not the manner in which the product was made. Therefore, the patentability of a product is independent of how it was made. In this regard, it is thus noted that since the plasticizer is removed from the positive electrode, the plasticizer and the removing solvent are not an active constituent of said positive electrode. That is, the plasticizer and the removing solvent were just employed as part of the preparation technique but the plasticizer was removed thereafter by using the solvent. Further, since the porosity of the positive electrode as claimed also includes "0 (zero) porosity" or "a pore-free material", it is hence asserted that no plasticizer and removing solvent is required.

As to claim 9:

Chu discloses the presence of polysulfide form material (COL 4, lines 30-36/ COL 4, lines 60-65).

As to claim 17:

Chu discloses the ionic conductor in the positive electrode can be any of the solid-state or gel-state electrolytes described in the electrolyte separators and liquid electrolyte sections (COL 10, lines 23-27) as well as any electronically insulating and ionically conductive material which is electrochemically stable may be used (COL 10, lines 46-55/ COL 9, lines 45-60/ COL 5, lines 9-15). In particular, Chu teaches the following organic liquids of the battery cell incorporating the positive electrode: propylene carbonate; ethylene carbonate, N-methylpyrrolidinone, butyrolactone, tetramethylurea and the likes (COL 11, lines 26-35).

As to claims 38:

Chu teaches the employment of solid electrolytes (Col 11, lines 8-15/ COL 5, lines 62-67/ Col 10, lines 23-27).

As to claim 39:

Chu teaches the use of polymeric, glass and/or ceramic materials are appropriate as solid-state electrolyte separators (Col 5, lines 62-67).

Chu et al disclose a lithium-sulfur battery comprising a sulfur-based positive composite electrode according to the foregoing aspects. However, Chu et al does not expressly disclose the specific pore size; and the pore size as recited in claim 3.

As to claims 1-3:

The JP'431 publication discloses a sodium-sulfur secondary battery with low voltage drop because of contact resistance wherein the battery comprises a cathode activator of a melted

sulfur (ABSTRACT); the sulfur is an electric insulator so that it is necessary to increase conductivity of the sulphur to react electrochemically in the battery (ABSTRACT). It is disclosed that it is essential to use a porous conductor consisting of a material having a degree of porosity with pore diameters of 10-1000 μm as a cathode member to increase the conductivity of the cathode (ABSTRACT).

(***EMPHASIS ADDED→***) The JP'431 discloses specific embodiments wherein the porous material of the disclosed electrode exhibits an average pore size (See EMBODIMENTS 1-7). Specifically, **EMBODIMENT 1** shows an average pore diameter of 20 μm; and **EMBODIMENT 7** also shows a pore diameter of 8 μm. *Thus, the JP'431 shows a pore diameter with sufficient specificity; and an average pore diameter sufficiently close to the claimed range. Additionally, the exemplified average pore diameters disclosed in JP'431 (20μm- Embodiment 1; 240μm- Embodiment 1; 350 μm- Embodiment 2; 170 μm- Embodiment 3) suggest the suitability of selecting any average pore diameter within the lower end of the entire disclosed range of 10-1000 μm. Simply, the JP'431 does not disclose, teach or suggest to select an average pore diameter higher than 350 μm and/or a pore size greater than 200 μm. Consequently, it is reasonable to conclude that the JP'431 at once envisages using an average pore size closer to the lower end of the disclosed range, namely, JP'431 at once envisages selecting an average pore size closer to 10 μm. Stated alternatively, working embodiments of the JP'431 show preferences for average pore sizes and/or pore sizes lower than 350 μm and/or 200 μm, respectively.*

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to make Chu et al's positive active material including sulfur by having the

specific pore size of the JP'431 publication because the JP'431 publication reveals that in battery system using sulfur it is essential to use a porous conductor consisting of a material having a degree of porosity with pore diameters of 10-1000 μm as a cathode member to increase the conductivity of the cathode, that is to say, to increase conductivity of the sulphur to react electrochemically in the battery. Thus, it is emphatically contended that the JP'431 publication discloses such cathodes having the specific pore size are better conductor and can be used in electrochemical applications involving alkali-metal technology. Therefore, since the prior art directly teaches a sulfur containing cathode having a pore diameter of at least 10-15 μm, a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to ***MPEP 2144.05 [R-1] Obviousness of Ranges*** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim 191 USPQ 90*; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson 65 USPQ2d 1379*. Hence, the JP'431 publication directly teach the use of sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity. Furthermore, the JP'431 publication and Chu et al share the same field of endeavor as they both address and disclose alkali metal-sulfur based batteries and their related technologies.

As to the specific pore size as recited in claim 3, it would have been obvious to a skilled artisan at the time the invention was made to make Chu et al's positive active material by having the claimed pore size because even though the JP'431 publication does not overlap or lie inside the claimed pore diameter a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are ***close enough*** that one skilled in the art would have

expected them to have the same properties. *Titanium Metal Corp. of America v. Banner 227 USPQ 773.* Moreover, the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine a satisfactory and optimum pore diameter. *The JP'431 publication discloses that the porosity and the pore size per se are essential to increase the conductivity of the cathode. Therefore, the specific porosity and pore size are taught to be a result-effective variable, and the discovery of optimum of result effective variable in a known process is ordinarily within the skill of art. In re Boesh 205 USPQ 215 (CCPA 1980). Thus, applicant's arguments concerning this matter have been fully considered but are unpersuasive.*

8. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu 5523179 in view of the Japanese publication JP 47-028431 as applied to claim 4 above, and further in view of Kovalev et al 6652440.

Chu and the JP'431 publication are applied, argued and incorporated herein for the reasons above. However, the preceding prior art does not expressly disclose the specific particle size of the elemental sulfur.

Kovalev et al teach electroactive cathode materials for electrochemical cells (COL 1, lines 10-15) wherein the cathode materials comprise sulfur-sulfur bond such as elemental sulfur (COL 1, lines 43-50). It is disclosed that such cathode materials are useful in batteries employing alkali-metal anode, in particular, lithium or lithium-alloy anodes (COL 1, lines 35-53/COL 16, lines 64-67). It is further disclosed that in one embodiment, **the particle size of elemental sulfur**

is from 0.01 to 100 microns (COL 5, lines 18-20/COL 12, lines 7-9). *It is noted that Kovalev et al's particle size range encompasses, at least, particle sizes up to 20 Tm, or 10 Tm or 5 Tm.*

In light of these disclosures, it would have been obvious to one skilled in the art at the time the invention was made to use the specific particle size of the elemental sulfur of Kovalev et al in the lithium-sulfur battery of Chu-the JP'431 publication as Kovalev et al teach that elemental sulfur having the claimed particle size is useful for making positive electrode of lithium-sulfur batteries because this particular positive electrode material exhibits satisfactory specific capacity in combination with a lithium anode. As a consequence, lithium-sulfur batteries employing elemental sulfur having the claimed particle size as positive electrode achieves high energy capacity and rechargeability by the electrochemical cleavage via reduction and reformation via oxidation of the elemental sulfur. *Hence, Kovalev et al directly teach the use of elemental sulfur having a particle size within the claimed range.* Therefore, since the prior art directly teaches that the particle size of elemental sulfur is from 0.01 to 100 microns, *including* at least from 0.01 μm up to 20 μm, a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to ***MPEP 2144.05 [R-1] Obviousness of Ranges*** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim 191 USPQ 90*; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson 65 USPQ2d 1379*. Hence, Kovalev et al directly teach the use of sulfur materials having a particle size within the claimed range.

Response to Arguments

9. Applicant's arguments filed 09/05/06 have been fully considered but they are still unconvincing. For reasons explained hereinbefore, prosecution on the merits is re-opened.

10. Having considered now the English translation of the JP'431 publication, the examiner likes to add the following in support of the prima-facie case of obviousness.

(***EMPHASIS ADDED→***) The JP'431 discloses specific embodiments wherein the porous material of the disclosed electrode exhibits an average pore size (See EMBODIMENTS 1-7). Specifically, **EMBODIMENT 1** shows an average pore diameter of 20 μm; and **EMBODIMENT 7** also shows a pore diameter of 8 μm. *Thus, the JP'431 shows a pore diameter with sufficient specificity; and an average pore diameter sufficiently close to the claimed range. Additionally, the exemplified average pore diameters disclosed in JP'431 (20μm- Embodiment 1; 240μm- Embodiment 1; 350 μm- Embodiment 2; 170 μm- Embodiment 3) suggest the suitability of selecting any average pore diameter within the lower end of the entire disclosed range of 10-1000 μm. Simply put, the JP'431 does not disclose, teach or suggest to select an average pore diameter higher than 350 μm and/or a pore size greater than 200 μm. Consequently, it is reasonable to conclude that the JP'431 at once envisages using an average pore size closer to the lower end of the disclosed range, namely, JP'431 at once envisages selecting an average pore size closer to 10 μm. Stated alternatively, working embodiments of the JP'431 show preferences for average pore sizes and/or pore sizes lower than 350 μm and/or 200 μm, respectively. Particularly, **working embodiment 1** uses an average pore size of 20 μm.*

11. Initially, applicant has contended that "*the combination of Chu and JP'431 does not teach or suggest all of the express limitations of independent claim 1...*", particularly that

"*JP'431 contains absolutely no teaching or suggestion as to what the average pore size is...*". Later, applicant contended that "*JP'431* clearly *teaches away from the lower range of pores for its conductor. In particular, referring to the full Japanese document, JP'431 describes that a graphite material having a pore size of 240 μm in Example 1, 350 μm in Example 2, 170 μm in Example 3, 200 μm in Example 5, and 150 μm in Example 6 improves the battery performances, but that a graphite material having a pore size 8 μm, as in Example 7, deteriorates the battery performance*". So, applicant's contention that JP'431 contains absolutely no teaching or suggestion about average pore size is categorically refuted by the examiner by the very same arguments that applicant provided subsequently. That is, applicant's admission that the JP'431, indeed, does disclose specific embodiments encompassing multiple pore size ranges. Thus, applicant's arguments are absolutely unintelligible and ill-founded.

12. Applicant has further argued that Examples 1-6 correspond to preferred embodiments and, therefore, the JP'431 teaches away from employing pore sizes in the lower end of the 10-1000 μm range because the lower end of the disclosed range in JP'431 appears to be a non-preferred embodiment. In this respect, a finding that the prior art as a whole suggests the desirability of a particular pore size need not be supported by a finding that the prior art suggests that the pore size claimed by the patent applicant is the preferred, or most desirable, combination. In other words, it is not required that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide motivation for the current invention. The question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making or selecting the claimed pore size, not whether there is something in the prior art as a whole to suggest that the combination is the most desirable

combination available. As a result, applicant's argument regarding the preference of Examples 1-6 to discredit the lower end of the disclosed range in JP'431 is not sufficient to overcome this rejection, and therefore, the applied disclosure which also encompasses many other pore sizes is valid, and pertinent thereto.

13. Applicant has argued that the JP'431 only exemplifies pore sizes in Examples 1-6 not lying within the claimed range, in response to that, the examiner asserts that:

a) a reference is good not only for what it teaches by direct anticipation but also for what one of ordinary skill might reasonably infer from the teachings. *In re Opprecht 12 USPQ 2d 1235, 1236 (Fed. Cir. 1989); In re Bode 193 USPQ 12 (CCPA 1976); In re Lamberti 192 USPQ 278 (CCPA 1976); In re Bozek 163 USPQ 545, 549 (CCPA 1969); In re Preda 159 USPQ 342 (CCPA 1968); In re Van Mater 144 USPQ 421 (CCPA 1965); In re Jacoby 135 USPQ 317 (CCPA 1962); In re LeGrice 133 USPQ 365 (CCPA 1962);*

b) a reference is not limited to working examples *In re Fracalossi 215 USPQ 569 (CCPA 1982);*

c) non-preferred embodiments can be indicative of obviousness. *Merch & Co. v. Biocraft Laboratories Inc. 10 USPQ 2d 1843 (Fed. Cir. 1989); In re Lamberti 192 USPQ 278 (CCPA 1976); In re Kohler 177 USPQ 399 (CCPA 1973); In re Mills 176 USPQ 196 (CCPA 1972); In re Bozek 163 USPQ 545 (CCPA 1969); In re Meinhardt 157 USPQ 270 (CCPA 1968); In re Boe 148 USPQ 507 (CCPA 1976); In re Nehrenberg 126 USPQ 383.*

14. In response to applicant's argument that "*there is no motivation to combine the teachings of Chu and JP'431...*" because "*Chu already suggests a mechanism for improving conductivity, which is to thoroughly and uniformly disperse an active-sulfur in an electronically conductive*

material and an ionically conductive material", the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

15. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., *homogeneous, or segregation or agglomeration or heterogeneity*) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). *For instance, even though applicant appears to be arguing that "Chu emphasizes... homogeneity, not heterogeneity or segregation or agglomeration..." and that JP'431 appears to be disclosing materials that "by its nature cannot be mixed with a sulfur material to form a homogenous composition", absent additional limitations in the claims further defining whether applicant's inventive material is homogeneous or heterogeneous the examiner finds that this argument adds nothing of significance to the patentability of the present claims. Why such a teaching is so important and relevant to the invention of the applicant, if applicant is not even concerned with that problem? Specific sulfur materials as active material having specific pore sizes is what is relevant to the claimed invention, not its degree of homogeneity or heterogeneity. If applicant wishes to have that limitation considered, such a limitation must be included in the present claims.*

(***Emphasis supplied→***) In general applicant has also argued that the prior of record is silent about "*the <u>average</u> pore size*" and "*the <u>average</u> particle size of element sulfur*". In doing so,

applicant appears to put a lot of emphasis on the term "average" per se to the point of apparently arguing that "*an average pore size (or particle size) can not be assumed from a disclosure of a range of pore sizes in a material*". However, while the examiner not necessarily disagrees with applicant's characterization of "average pore size" and "average particle size" as a single feature, the examiner strenuously contends that the present claim language makes no attempt to specifically and unequivocally characterizes "average pore size" and "average particle size" as such. For example, the recitation "*an average size greater than or equal to substantially 5 μm and less than and including 15 μm*" and "*an average particle size of the elemental sulfur is greater than 0 μm and is up to 20 μm*" fully include a range within which the "average" size can lie. Although that language may meet section 112 requirements for purpose of definiteness, certainly, it opens the possibility of including "a range within the average range" [*sic*] of the particle size or pore size. Therefore, while applicant's characterization of the average pore size or particle size may be correct, such a characterization in no way is reflected in the present claims. All in all, applicant's recitation of "an average size lying within a claimed range" can be reasonably construed as essentially claiming different particles sizes rather than an average size as a whole. Simply put, an average size does inherently includes a distribution of different sizes which in average produces a " specific average size"; nonetheless, having a range for an average size does not strictly translates into having only one specific average size, actually, it might be translated into having a size range for multiple pore/particle size distributions, and/or a range for specific particle/pore sizes. Which one is applicant intending to recite? This is certainly unknown at this point and based on applicant's arguments. To that effect, a reasonable interpretation of the present claim language (not even the broadest reasonable interpretation) may lead a skilled

artisan in the art to understand that applicant's claimed "average size" is not actually making reference to the average size per se, but simply to a pore size of between 5 μm and 15 μm; and a particle size ranging from 0 μm to 20 μm.

16. The gist of applicant's arguments remains substantially equal to all of the previously presented arguments. Accordingly, applicant's contention is substantially the same contention (arguments) brought to the examiner's attention in the last two amendments dated 10/04/05 and 04/06/05 and to which office actions and responses addressing such contention (arguments) have been already issued in prior office actions dated 05/04/05 and 10/24/05. Thus, the examiner verily believes that most of applicant's arguments have been already properly twice-addressed and responded to. Therefore, the response to applicant's arguments is being repeated here for applicant's convenience.

17. The examiner likes to briefly note this new response to applicant's arguments. The rest of the responses, as herein mentioned, have been previously presented:

18. In this case, it is noted that, at least, one of the two end point of the JP'431 (*i.e. 10 μm*) constitutes a valid data point and thus it fully encompasses the claim as the end point represents a specific disclosure of a discrete embodiment of the invention disclosed by the prior art which amounts to a complete description and, therefore, an anticipation of the claimed range. **See Ex Parte Lee 31 USPQ2d 1105.**

19. (old responses) By way of review, applicant is contending that "there is no motivation to combine the references because... Chu present different solutions to the same conductivity problem...Chu would not suggest looking to the specific porosity " and that "the JP'431 teaches using melted sulfur (infusing)" and that "the broad range of pore sizes disclosed in JP'431 does

not overlap...". In response to applicant's argument that the two references are not combinable, the fact that applicant has recognized another advantage/disadvantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See Ex parte Obiaya, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). In addition to that, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. (←**Emphasis added**) See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Moreover, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Lastly, applicant is reminded that a showing of unexpected results should include a direct comparison between the claimed invention and the closest prior art. To that effect, applicant has not demonstrated that unexpected results are obtainable over the combined-applied art. Burden is on applicant to furnish objective evidence demonstrating so. Accordingly, a strong prima-facie case of obviousness is deemed to still exist as the combined prior art (i.e. Chu and JP'431) directly teach all the claimed features, particularly, the instantly claimed invention including pore size within the claimed range. Thus, it is believed that the prima-facie case of obviousness is strong enough.

20. The principal contention of applicants' arguments is now premised on the assertion that "a prima-facie case of obvious does not exist simply because the JP'341 publication describes a solution to a problem already solved in Chu in regards to sulfur conductivity and does not suggest that the solution is advantageous over the solution proposed in Chu" (i.e. "*Chu already suggests a solution to the very problem which JP'431 purports to solve*"). However, this assertion is still insufficient to over the 35 USC 103 obviousness rejection because the test for obviousness is not whether the features of a secondary reference may be bodily (i.e. functionally) incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art (***emphasis added***). See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Moreover, the fact that applicant has recognized another advantage/disadvantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Moreover, not because the two references solve the conductivity issue in apparent dissimilar ways, the specific teaching of the pore size of the JP'341 publication becomes irrelevant to the general teachings of Chu. Therefore, the applied obviousness rejection will be maintained unless applicants provide objective evidence demonstrating that the JP'341 publication's material including the claimed pore size cause deleterious or catastrophic effects if used in the lithium-sulfur battery of Chu. The burden is shifted to the applicants.

21. With respect to applicants' arguments that,"there is no expectation s to which element of this large range would achieve best conductivity, nor an invitation to explore pore diameters

below 10 μm or above 1000 μm (i.e. in reference to the teachings of the JP'431)", the examiner contests that given that the JP'431 publication directly teaches a sulfur containing cathode having a pore diameter of at least 10-15 μm, a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379. Hence, the JP'431 publication directly teaches using sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity. Moreover, having presented reasonable ground of rejection based on the teachings of such Japanese publication (i.e. the JP'431 publication), it is contended that the JP'431 publication discloses that it is essential to use a porous conductor [in sulfur containing cathodes and batteries] consisting of a material having a degree of porosity with pore diameters of 10-1000 μm as a cathode member to increase the conductivity of the cathode. As a result, the examiner has presented reasonable and justifiable evidence to maintain that that the prior art certainly imparts criticality to the pore diameter.

22. As to the assertion that "Kovalev et al suggest multiple particle sizes for elemental sulfur, including particles from 0.01 to 100 microns, but Kovalev et al does not suggest which particle size should be used within this broad range, or which portion is advantageous to use", the examiner again contests that given that Kovalev et al directly teaches that the particle size of elemental sulfur is from 0.01 to 100 microns, including at least from 0.01 μm up to 20 μm, a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to

MPEP 2144.05 [R-1] Obviousness of Ranges where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379. Hence, Kovalev et al directly teach the use of sulfur materials having a particle size within the claimed range.

23. As to the specific pore size as recited in claim 3, it is stated that a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are ***close enough*** that one skilled in the art would have expected them to have the same properties. *Titanium Metal Corp. of America v. Banner 227 USPQ 773.* Moreover, the normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine a satisfactory and optimum pore diameter. The JP'431 publication discloses that the porosity and the pore size per se are essential to increase the conductivity of the cathode. Therefore, the specific porosity and pore size are taught to be a result-effective variable, and the discovery of optimum of result effective variable in a known process is ordinarily within the skill of art. In re Boesh 205 USPQ 215 (CCPA 1980). Thus, applicant's arguments concerning this matter have been fully considered but are unpersuasive.

24. With particular respect to applicants' arguments regarding the broad range (including both the pore diameter range and/or the broad particle size range of Kovalev et al), the examiner now categorically contends that the JP'431 publication positively discloses such cathodes having the specific pore size are better conductor (conductivity is increased) and can be used in electrochemical applications involving alkali-metal technology; in addition, it is also stated that Kovalev et al directly teach the use of elemental sulfur within the claimed particle size. Hence,

since the prior art of record directly teaches a sulfur containing cathode having a pore diameter of at least 10-15 μm (*regardless the entire disclosed range from 10-1000 μm*) and elemental sulfur having a particle size ranging from 0.01-100 μm, a prima-facie case of obviousness still exists. Applicants' attention (**emphasis added**) is respectfully directed to ***MPEP 2144.05 [R-1] Obviousness of Ranges*** where is stated that in the case where the claimed range lies inside or overlaps a range disclosed by the prior art a prima-facie case of obviousness exists. *In re Wertheim 191 USPQ 90*; or at least, is sufficient to establish a prima-facie case of obviousness. *In re Peterson 65 USPQ2d 1379*. In particular, the JP'431 publication directly disclose the use of sulfur cathode materials having a pore size within the claimed range by positively stating that the pore diameter is critical to achieve the desired cathode conductivity; and Kovalev et al's particle size range encompasses the claimed one.

25. In the event that applicants further argue that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the JP'431 publication and Chu et al share the same field of endeavor and/or at least are pertinent to the particular problem with which the applicant was concerned as they both address and disclose alkali metal-sulfur based batteries and their related technologies.

26. As to the assertion that the prior art "does not suggest advantage to any of these ranges as evident from Figures 4 and 5 and Tables 1 and 2 and paragraph 0023 and 0024" and that

"applicant's range imparts a novel feature as compared to the general conditions suggested in the existing art", it is noted that applicants' results show that the particular range is critical for a particle size of 5 μm only. For example, EXAMPLES 1-4 show the use of particle sizes of 5 μm only (SEE EXAMPLES 1-4). Further, Applicants are also comparing EXAMPLES 1-4 having a particle size of 5 μm with COMPARATIVE EXAMPLES 1-2 having particle sizes of 30 μm and 15 μm, respectively. Thus, as apparently admitted by the applicants, there is no unexpected result for the claimed range of particle sizes greater than about 15 μm. In addition, the results of Tables 1-2 of which applicants claim to show unexpected results are only commensurate with the specific particle size of 5 μm. Hence, applicants have failed to provide objective evidence establishing the advantage of particle sizes throughout the entire claimed range (i.e. greater than or equal to 5 and less than and including 15 μm). Thus, it is considered that particle sizes immediately below about 5 μm and greater than 5 μm (i.e. 0 < particle size (μm) < 5 and 5 < particle size (μm) α 15) has no effect on the life cycle of the resulting battery. Therefore, since the prior art directly teaches particle sizes greater than 5 μm, a prima-facie case of obviousness still exists. Applicants' attention is respectfully directed to **MPEP 2144.05 [R-1] Obviousness of Ranges** where is stated that in the case where the claimed range lie inside a range disclosed by the prior art a prima-facie case of obviousness exists. In re Wertheim 191 USPQ 90; or at least, is sufficient to establish a prima-facie case of obviousness. In re Peterson 65 USPQ2d 1379.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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